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absence of birds in the Silurian, which might well deter the boldest speculator from offering such an explanation; but when we consider that permanent bodies of fresh water were undoubtedly formed by the gradual freshening of bodies of salt water cut off from the ocean, and that such bodies of fresh water usually had outlets connecting them with the sea, it is not surprising that Fritz Müller, Dohrn, and others should overlook a difficulty which is no greater for Phyllopoda than for other groups of freshwater animals.

In the chapter on his new order, Phyllocarida, and its systematic position, Professor Packard describes the anatomy and development of *Nebalia*, and discusses its fossil allies. The appendages of *Nebalia bipes* are described and fully figured, but on the internal anatomy very little that is new is given. The figures and text intended to elucidate the histology, like most of Professor Packard's similar work, leave much to be desired.

The bibliography consists of a hundred and thirty-eight titles, divided into four sections, — one for living and one for fossil Phyllopoda, and the same for Phyllocarida. The titles of many of the works referred to are omitted in the bibliography, which is evidently very incomplete; but its incompleteness is not so annoying as the entire want of system in its arrangement, and the frequency of typographical errors.

Typographical errors are very numerous in all parts of the work; and many of them cannot properly be charged to the proof-reader, who, however, ought to have corrected blunders like 'Yahresbericht' (several times) and 'zoogloical,' and the inexplicable punctuation of most of the bibliographical references in the systematic parts of the work. Errors due to careless writing or careless compiling are more common than purely typographical errors, and far more confusing. On p. 313 we have the following: "It is difficult to say whether this is a *Limnadia* or *Estheria*, as the description is too brief and inexact to enable us to determine the genus or species. It cannot be a *Limnadia*, and seems to approximate more closely to *Estheria*; though it cannot belong to that genus." On p. 335 it is said that 'Schmankevitich' found '*Branchinecta ferox* (Fischer sp.)' transform by artificial means into *Artemia*; but in reality he found an *Artemia* change into a *Branchinecta*, or into what he considered a *Branchipus*. On p. 337, 'Labrador examples' are said to have been taken 'on the north side of Hamilton Inlet, Northern Greenland.' On pp. 313 and 314 the species

of *Estheriinae* not recognizable are inserted between two species of *Eulimnadia* instead of at the end of the sub-family. Two paragraphs at the bottom of p. 349, under *Streptocephalus Sealii*, should have been placed under *Chirocephalus Holmani*, on p. 352. On pp. 356 to 358 the genus *Leaia* is inserted between two species of *Estheria*.

The plates, perhaps the most valuable part of the work, are nearly all lithographs from the establishment of Thomas Sinclair & son, and are apparently accurate representations of the original drawings. The general figures, mostly drawn by Emerton and Burgess, are excellent. The figures of details, drawn by the author, are not always so satisfactory: the figures of the appendages of *Apus* and *Lepidurus*, for example, are very rudely drawn, and badly arranged on the plates. Unfortunately, the amount of enlargement of scarcely any of the figures is given. S. I. SMITH.

SIR WILLIAM LOGAN.

Life of Sir William E. Logan, Kt., LL.D., F.R.S., F.G.S., etc., first director of the Geological survey of Canada. By BERNARD J. HARRINGTON, B.A., Ph.D., professor of mining in McGill university. Montreal, Dawson Bros., 1883. With steel portrait and numerous woodcuts. 432 p. 8°.

A LIFE of Logan will be greeted by all geologists as a fit companion for those which have recently appeared of his English colleagues, Lyell and Murchison. What they did for Great Britain, he did for his native Canada, and even more. He solved the most complicated geological problems in vast areas where no white man had ever trod before him. He forced his way through trackless forests, making his own surveys and maps as he proceeded, and, in spite of such difficulties, not only discovered the structure of a greater part of his own country, but gave to the world a new series of formations. The work of Murchison and Sedgwick he completed by carrying order and succession beyond the Silurian and Cambrian, into that chaos of still older rocks, thus rendering the soil of his beloved Canada forever classic in geological annals.

The author of the present memoir has given us Sir William's history almost in his own words. By means of judicious extracts from his voluminous correspondence and journals, chronologically arranged, we are presented with a charming picture of the man, as well as the *savant*, all the more faithful because it is unconsciously given. Here we see portrayed

an indomitable will, the keenest power of observation, as well as the coolest judgment in drawing conclusions, rare tact in managing his fellow-men, a ready sense of humor, combined with those subtler qualities of heart which make a man *beloved* wherever he may be. The author has rendered his work doubly attractive by making it sort of an unintentional autobiography.

Sir William Edmond Logan was born in Montreal, April 20, 1798, and remained at home until he was sent to the Edinburgh high school, in 1814. He studied at the high school and university of this place until 1817, when he entered upon a mercantile life in London, which he continued during the following fourteen years. In 1831 he was placed in charge of a copper company, near Swansea, in Wales, where he exhibited for the first time his geological proclivities. This company mined its own coal, and it was through this fact that he was led to his first really scientific investigations. He prepared a map of the South Wales coal-district with a degree of accuracy which had hardly before been equalled by any geological workers. This map attracted much attention from De la Beche, and other of England's most prominent geologists, and secured him influential friends who ever remained true to him.

In 1840 Logan returned to his native land, and spent over a year in studying the coal formation in New Brunswick and Pennsylvania. The results of his investigations relating to the origin of coal *in situ* were published soon after he returned to England. The subject of a government geological survey had been for some time under discussion in Canada, when, in 1841, £1,500 was appropriated for this purpose; and in the following year Logan received, upon the recommendation of his friends De la Beche, Murchison, Buckland, and Sedgwick, the appointment of director. During the seasons of 1843-44 he devoted his attention to studying the peninsula of Gaspé, where coal had been reported, and, in an incredibly short time, unravelled the geological complexities of a vast wilderness. The coal was not found, but its absence from the Silurian and Devonian rocks which compose that region was placed beyond a doubt.

But notwithstanding the energy with which Logan's work was carried on, and the success which attended it, his efforts to awaken in his countrymen an interest in geological pursuits were for a long time not appreciated. Years of doubt and anxiety followed the opening of the survey; and it was only through the indom-

itable will and consummate tact of its director that the opposition of a short-sighted government was finally overcome, and its permanent existence assured.

Although nothing was more foreign to Sir William's character than a taste for display, or a desire for fame, he fully appreciated the advantages to the survey and to Canada which must arise from having the results of his work widely known. Thus it was that he willingly undertook the charge of the Canadian exhibit at three world's fairs, — London in 1851 and 1862, and Paris in 1855, — and was more than repaid for his untiring exertions by the success which attended them. He saw, largely through his own efforts, an active interest in his native land awakened in Europe, the knowledge of her resources extended, and her industries and wealth thereby increased; while these practical results of his own work secured to him the encouragement of his countrymen, and honors poured fast upon him from all quarters. His appropriations were increased year by year; the best specialists were associated with him in different departments, such names as Hunt, Murray, and Billings, adding no little lustre to the survey's name; the field of work was extended over all of Canada that was accessible; and ample opportunity was given for the publication of scientific results.

Into the details of Sir William's special work we have here no time to enter: suffice it to say, that the sphere of his labors was very varied, as the list of his memoirs appended to the present work will show, his discoveries numerous and important, and all that he accomplished most thoroughly and accurately done. But the survey was always his especial care; and he may well have considered his life's work performed, when, at his resignation from the directorship in 1869, he could leave it upon a permanent footing, provided with every facility for future activity and usefulness. To the close of his life, his interest in its work never abated; and his last thoughts were devoted to completing some of his investigations begun as its director.

In August, 1874, Sir William once more went to England, and died the following June, at his sister's house in Wales. As a geologist, he will always be honored in the scientific world; while, as a man and as a friend, he will long be remembered by those who were never able to appreciate his work.

A very valuable paper on the history of the rocks of the Quebec group, by Principal Dawson of McGill college, forms a most welcome addition to this, of itself, so interesting book.